

Maxim Makatchev

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POSITIONS HELD

National Institute of Informatics (Japan) , Research Intern	8.2007
Intel Research (Pittsburgh) , Research Intern	5.2007 – 7.2007
University of Pittsburgh , Visiting research associate, Research programmer	10.2000 – 8.2006
City University of Hong Kong , Research assistant	11.1997 – 3.1998

EDUCATION

- PhD student, Robotics Institute, Carnegie Mellon University 2006 – present
- MPhil, Mechatronic Engineering, City University of Hong Kong 2001
- Diploma ($\sim MSc$), Applied Mathematics, Moscow State University, graduated with distinction (QPA 4.86/5, major QPA 4.93/5) 1997

HONORS

- ICML/UAI/COLT volunteer and travel grant 2008
- HRI Pioneers Workshop, ACM/IEEE HRI Conference, participation grant 2007
- CIME (Centro Internazionale Matematico Estivo, Italy), participation grant 2002
- Distinction, Diploma, Applied Mathematics, Moscow State University 1997
- Third place, Tashkent City Mathematical Olympiad 1992

RESEARCH AND ACADEMIC EXPERIENCE

Robotics Institute, Carnegie Mellon University, PhD student 8.2006 – present

Advisor: Reid Simmons

Project: *Roboceptionist*

- Common ground, dialogue management and learning [1–3].

PI: Daniel B. Neill (with Auton Lab)

Project: *Machine learning for anomaly detection in spatio-temporal data*

- Extended spatial scan statistics to incorporate learning [5].

National Institute of Informatics (Japan), Research Intern 8.2007

PI: Shinichi Honiden, Nik Nailah Binti Abdullah, Honiden Lab (U. of Tokyo/NII)

Project: *Instant Messaging Data Mining*

- Developed dialogue act predictors and estimated the size of necessary context.

Intel Research (Pittsburgh), Research Intern 5.2007 – 7.2007

PI: Denver Dash, Distributed Detection and Inference (DDI)

Project: *Applying Spatial Scan Statistics for Network Intrusion Detection*

- Developed metrics relevant for network data and applied spatial scan statistics to detect slow worm attacks.

Carnegie Mellon University, V-Unit participant 9.2006 – 4.2007
Project: *BlindAid: Spoken Language Interaction for Indoor Navigation Assistant*
• Interaction design for a handheld navigation aid for the visually impaired.

University of Pittsburgh, Research programmer 4.2001 – 8.2006
Visiting research associate 10.2000 – 4.2001
Learning Research and Development Center (LRDC), Natural Language Tutoring Group
Project: *Why2-Atlas: A Dialogue-Based Explanation Tutoring System*
• Implemented symbolic (ATMS [8], abductive reasoning-based [6, 13, 14–18]) and statistical (Bayesian networks [6]) systems for deep natural language understanding in a dialogue-based tutoring system.
• Designed knowledge representation and rules for the symbolic and statistical NLP back-ends (qualitative mechanics and student’s beliefs) [1,6-18].

City University of Hong Kong, Research student (MPhil) 3.1998 – 10.2000
Dept. of Manufacturing Engineering and Engineering Management
Advisors: S. K. Tso, S. Lang
Thesis: *Computational Issues on Design and Implementation of an Autonomous Guided Vehicle*
• Wrote motion control software for a four-wheel-steering mobile robot [20, 21].
• Designed and implemented an agent-based human-robot interface via Internet, an XML-based markup language/ontology (RoboML) [19].

City University of Hong Kong, Research assistant 11.1997 – 3.1998
Dept. of Manufacturing Engineering and Engineering Management
Project: *Design and Implementation of a Self-Navigation and Intelligent Control System for an Autonomous Guided Vehicle*
• Investigated complexity of tessellation automata-based image processing [22].
• Extended a dynamic model of a four-wheel-steering mobile robot with tire-ground contact forces (Matlab and Maple).

Moscow State University, Diploma (~MSc), Applied Math. 9.1992 – 6.1997
Dept. of Mathematical Cybernetics, Fac. of Computational Mathematics & Cybernetics
Advisor: V. N. Kozlov
Thesis: *On a Tessellation-based Model of Mammalian Visual System*
• Derived metric and complexity properties of a class of tessellation automata.

Moscow State University, Student assistant 9.1995 – 8.1996
Robotics Laboratory, Institute of Mechanics
PI: E. A. Devjanin
Project: *Machine Vision System for the Six-legged Walking Robot MASCHA*
• Filtering and feature extraction for active and passive robot vision systems.

OTHER PROFESSIONAL EXPERIENCE

Joint Stock Company ACRON, Assistant to Chief Specialist 10.1995 – 10.1997
JSC “Acron” (Moscow) – “Fimochim” SA (Geneva)
• DBMS, LAN design.

TEACHING EXPERIENCE

Carnegie Mellon University

- Teaching assistant: 15-451, Algorithms (Manuel Blum) Spring 2009

City University of Hong Kong

- Teaching assistant: Engineering mechanics Spring 2000
- Teaching assistant: Control principles and applications Fall 1999
- Instructor: Basic mechanics labs Spring 1999
- Instructor: Automation technology labs Fall 1998
- Instructor: Control engineering labs Spring 1998

GRADUATE COURSEWORK (CMU)

Machine learning; Computational complexity; Optimization; Statistical machine learning; Probabilistic graphical models; Machine learning theory; Intermediate statistics; Kinematics, dynamics and control; Computer vision; Technically speaking.

JOURNAL PUBLICATIONS

- [1] “**Abductive Theorem Proving for Analyzing Student Explanations to Guide Feedback in Intelligent Tutoring Systems,**” by M. Makatchev, P. W. Jordan, K. VanLehn. *Journal of Automated Reasoning, special issue on Automated Reasoning and Theorem Proving in Education*, vol. 32, issue 3, pp. 187–226, 2004.

REFEREED CONFERENCE AND WORKSHOP PUBLICATIONS

Human-robot dialogue

- [2] “**Incorporating a User Model to Improve Detection of Unhelpful Robot Answers,**” by M. Makatchev and R. Simmons. *Int. Symp. on Robot and Human Interactive Communication, RO-MAN’2009*, September 2009, pp. 973–978.
- [3] “**How do people talk with a robot? An analysis of human-robot dialogues in the real world,**” by M. K. Lee and M. Makatchev. *Proc. of Int. Conf. on Human factors in computing systems, CHI’2009*, April 2009.
- [4] “**Relating initial turns of human-robot dialogues to discourse,**” by M. Makatchev, M. K. Lee, and R. Simmons. *Late-breaking paper for Conf. on Human-Robot Interaction, HRI’2009*, March 2009.

Anomaly detection

- [5] “**Learning Outbreak Regions in Bayesian Spatial Scan Statistics,**” by M. Makatchev and D. B. Neill. *Proc. ICML/UAI/COLT Workshop on Machine Learning for Health Care Applications*, Helsinki, 2008.

Symbolic and statistical NLP

- [6] “**Combining Bayesian Networks and Formal Reasoning for Semantic Classification of Student Utterances,**” by M. Makatchev and K. VanLehn. *AIED2007*, Los Angeles, 2007.
- [7] “**Understanding Complex Natural Language Explanations in Tutorial Applications,**” by P. Jordan, M. Makatchev and U. Pappuswamy. *Proc. of ScaNaLU, HLT/NAACL*, New York City, June 2006, pp. 17–24.

- [8] “**A Natural Language Tutorial Dialogue System for Physics,**” by P. Jordan, M. Makatchev, U. Pappuswamy, K. VanLehn and P. Albacete. *Proc. of FLAIRS*, Florida, 2006.
- [9] “**Representation and Reasoning for Deeper Natural Language Understanding in a Physics Tutoring System,**” by M. Makatchev, K. VanLehn, P. Jordan and U. Pappuswamy. *Proc. of FLAIRS*, Florida, 2006.
- [10] “**Mixed Language Processing in the Why2-Atlas Tutoring System,**” by M. Makatchev, B. Hall, P. Jordan, U. Pappuswamy and K. VanLehn. *Proc. of Workshop on Mixed Language Explanations in Learning Environments, AIED2005*, Amsterdam, Netherlands, 2005.
- [11] “**Analyzing Completeness and Correctness of Utterances Using an ATMS,**” by M. Makatchev and K. VanLehn. *Proc. of AIED2005*, Amsterdam, Netherlands, IOS Press, 2005.
- [12] “**Modeling Students’ Reasoning about Qualitative Physics: Heuristics for Abductive Proof Search,**” by M. Makatchev, P. W. Jordan, and K. VanLehn. *Int. Conf. on Intelligent Tutoring Systems*, Brazil, 2004, Springer LNCS, vol. 3220, pp. 699–709.
- [13] “**Combining Competing Language Understanding Approaches in an Intelligent Tutoring System,**” by P. W. Jordan, M. Makatchev, and K. VanLehn. *Int. Conf. on Intelligent Tutoring Systems*, Brazil, 2004, Springer LNCS, vol. 3220, pp. 346–357.
- [14] “**Abductive Proofs as Models of Students’ Reasoning about Qualitative Physics,**” by M. Makatchev, P. W. Jordan, U. Pappuswami, and K. VanLehn. *Int. Conf. on Cognitive Modelling*, Pittsburgh, 2004, Lawrence Erlbaum Associates Publishers, Mahwah, New Jersey, pp. 166–171.
- [15] “**Abductive Proofs as Models of Qualitative Reasoning,**” by M. Makatchev, P. W. Jordan, U. Pappuswamy, and K. VanLehn. *Int. Workshop on Qualitative Reasoning*, Evanston, Illinois, USA, 2004, pp. 11–18.
- [16] “**The Architecture of Why2-Atlas: A Coach for Qualitative Physics Essay Writing,**” by K. VanLehn, P. W. Jordan, C. P. Rose, D. Bhembe, M. Boettner, A. Gaydos, M. Makatchev et al. *Proc. 6th Int. Conf. Intelligent Tutoring Systems*, Biarritz, France and San Sebastian, Spain, June 2–7, 2002, Springer LNCS 2363, pp. 158–167.
- [17] “**Abductive Theorem Proving for Analyzing Student Explanations,**” by P. W. Jordan, M. Makatchev, K. VanLehn. *Int. Conf. on AI in Education, AIED*, 2003, Sydney, Australia, IOS Press, pp. 73–80.
- [18] “**Extended Explanations as Student Models for Guiding Tutorial Dialogue,**” by P. W. Jordan, M. Makatchev, U. Pappuswamy. *Natural Language Generation in Spoken and Written Dialogue*, 2003 AAI Spring Symposium Technical Report SS-03-06, pp. 65–70.

Modelling, control, and human-robot interface for mobile robots

- [19] “**Human-Robot Interface Using Agents Communicating in an XML-Based Markup Language,**” by Maxim Makatchev, S. K. Tso. *Proc. of the IEEE International Workshop on Robot-Human Interaction, RO-MAN2000*, September 2000, Osaka, Japan, pp. 270–275.

[20] “**Cross-Coupling Control for Slippage Minimization of a Four-Wheel-Steering Mobile Robot,**” by Maxim Makatchev, Sherman Y. T. Lang, S. K. Tso, John J. McPhee. *Proc. of the International Symposium on Robotics (ISR 2000)*, Montreal, Canada, May 14–17, 2000, pp. 42–47.

[21] “**System Design, Modelling, and Control of a Four-Wheel-Steering Mobile Robot,**” by Maxim Makatchev, Sherman Y. T. Lang, S. K. Tso, John J. McPhee. *Proc. of the 19th Chinese Control Conference*, December 6–8, 2000, Hong Kong, China, pp. 759–763.

Complexity of picture language recognition

[22] “**On the Complexity of Image Processing and Pattern Recognition Algorithms,**” by Maxim Makatchev, Sherman Y. T. Lang. *Proc. of the International Workshop on Image, Speech, Signal Processing and Robotics*, September 3–4, 1998, Hong Kong, China, vol. 1, pp. 217–222.

TALKS

- **Computationally Efficient Cross-Coupling Control of a Four-Wheel-Steering Mobile Robot.** Invited talk, National Research Council of Canada, May 2000, London, Ontario, Canada.
- **On the Complexity Measure for Cellular Automata-based Image Processing and Pattern Recognition Algorithms.** *International Conference on Theoretical Computer Science, in Honour of Prof. Manuel Blum’s 60th Birthday*, April 1998, Hong Kong.

DEMOS

- **Interactive Conceptual Tutoring in Atlas-Andes.** *The Second Meeting of the North American Chapter of the Association for Computational Linguistics, NAACL 2001*, Carnegie Mellon University (with C. P. Rosé, P. Jordan, K. VanLehn et al.)

SERVICE

- Co-organizer, Human-Robot Interaction Young Researchers Workshop (in conjunction with ACM/IEEE HRI Conference) 2008, 2009
- Reviewer, International Conference on AI in Education (AIED) 2007
- Co-chair, reviewer, Workshop on Mixed Language Explanations in Learning Environments, in conjunction with Int. Conference on AI in Education (AIED) 2005
- Reviewer, Conference of the Cognitive Science Society 2005, 2006
- Articles reviewer, Journal of Automated Reasoning, special issue on Automated Reasoning and Theorem Proving in Education 2003–2004
- Reviewer, International Conference on Cognitive Modelling 2004

SOFTWARE DEVELOPMENT SKILLS

- Python, Lisp, C, C++, Perl, Pascal, Forth, SQL, XML, PHP.
- Linux, MacOS, OSX, Harmony embedded RTOS.
- L^AT_EX.
- Matlab, R, Maple.

NATURAL LANGUAGES

- Russian — mother tongue.
- English — fluent.
- Japanese — basic spoken and written.